

Expanding the FALCON Telescope Network into the data science era

Dr. José Luis Nilo Castellón
On behalf of the FALCON-MMO team







OBJECTIVE:

Support University of La Serena to maintain & operate AFOSR- sponsored Falcon Telescope Network node for SSA, astronomy, education and outreach.

RESEARCH AREAS :

- Space Situational Awareness
 - Simultaneous observations of unresolved GEOs
 - Multi-pose, multi-sensor analysis
- Astronomy
 - Fast response global network
 - Transient sources
 - Exoplanet search





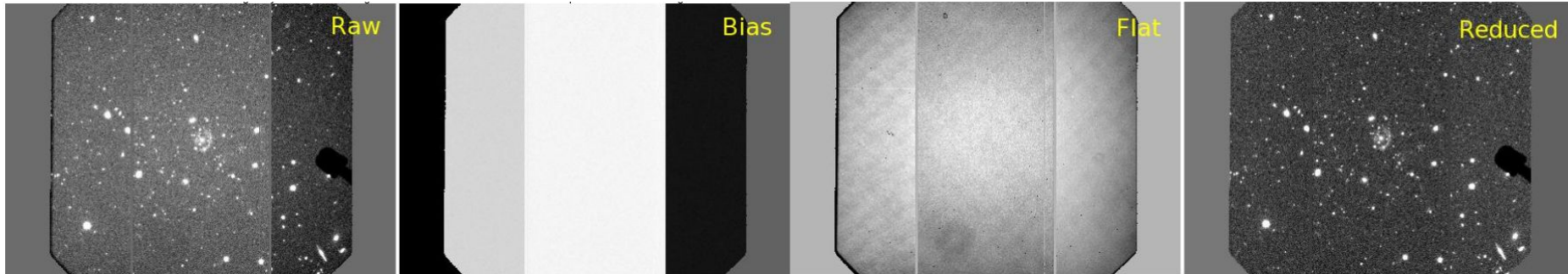
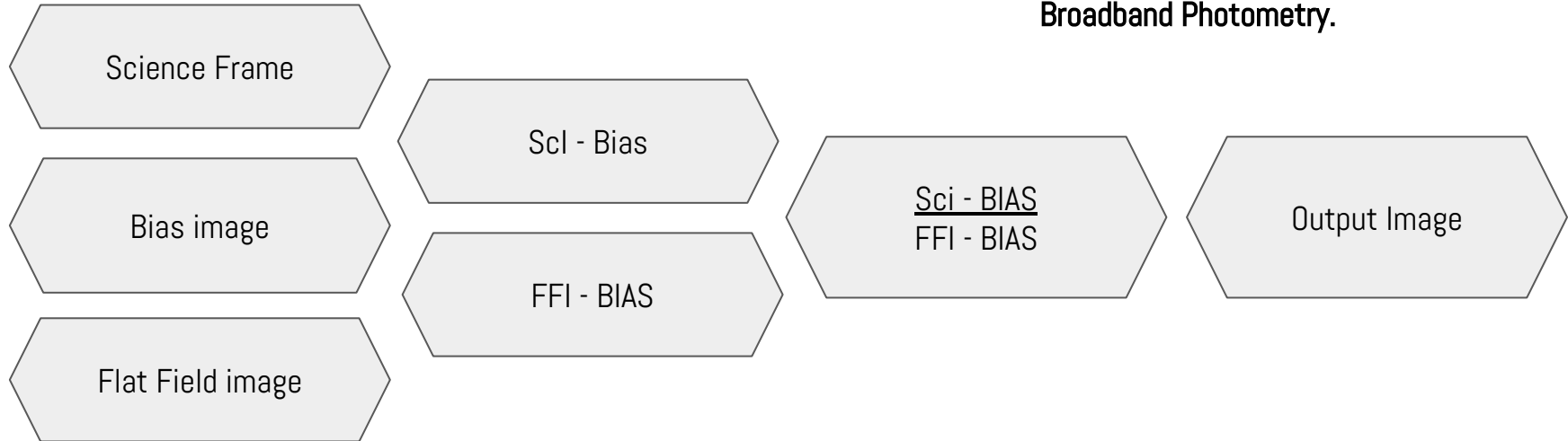
Non-resolved satellite multi-modal data fusion

Grant N°FA9550-18-1-0018

OBJECTIVE:

University of La Serena and the U.S. Air Force Academy will provide multi-phenomenology collection capabilities including spectroscopy and polarization in addition to a standard set of filters available across its many telescope assets. Collection of the different phenomenologies and the development of representations and algorithms to fuse them in to a usable set for identification of individual satellites is the next step in the use of small telescopes for SSA.

Broadband Photometry.



Science

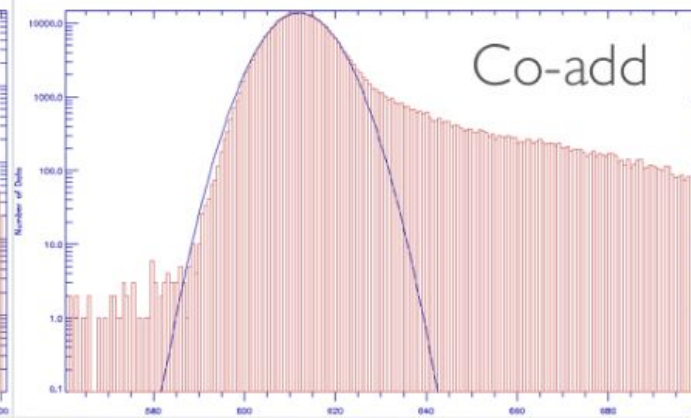
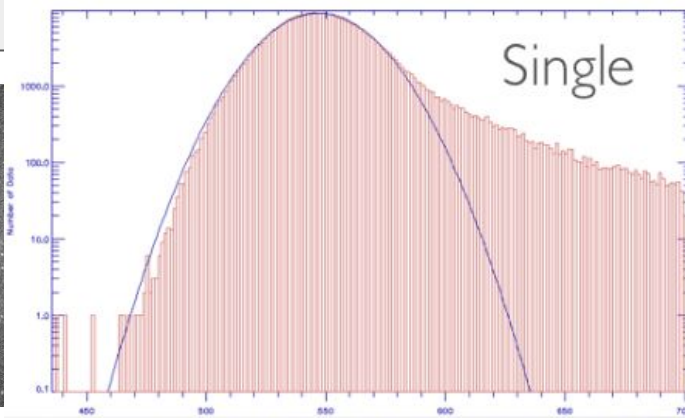
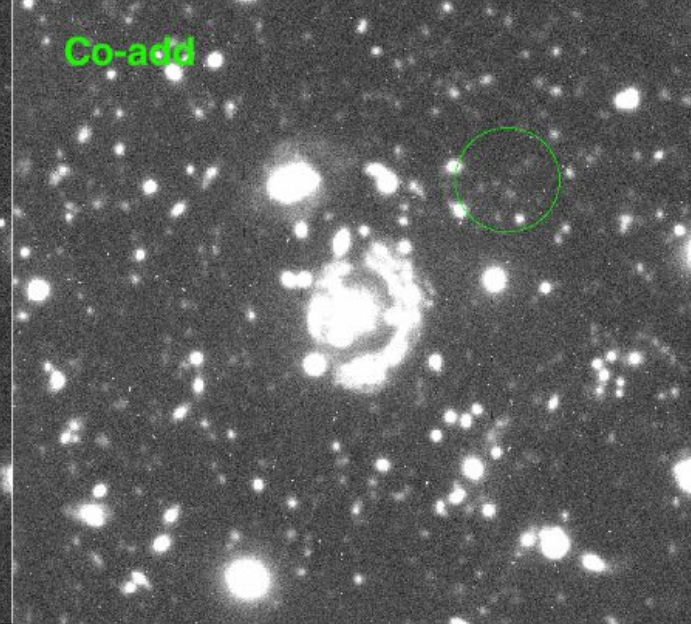
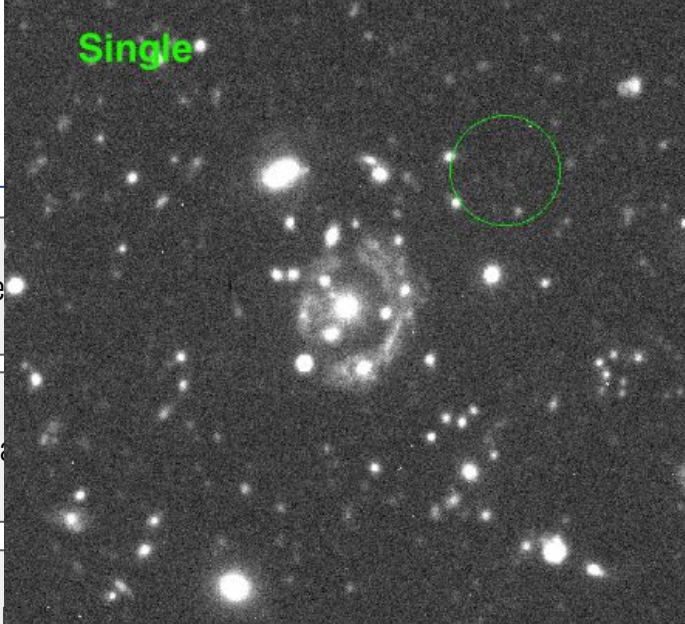
Biology

Flat

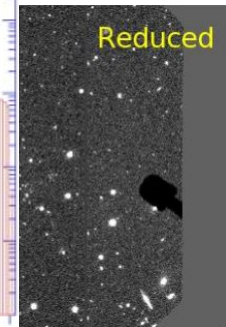
Image

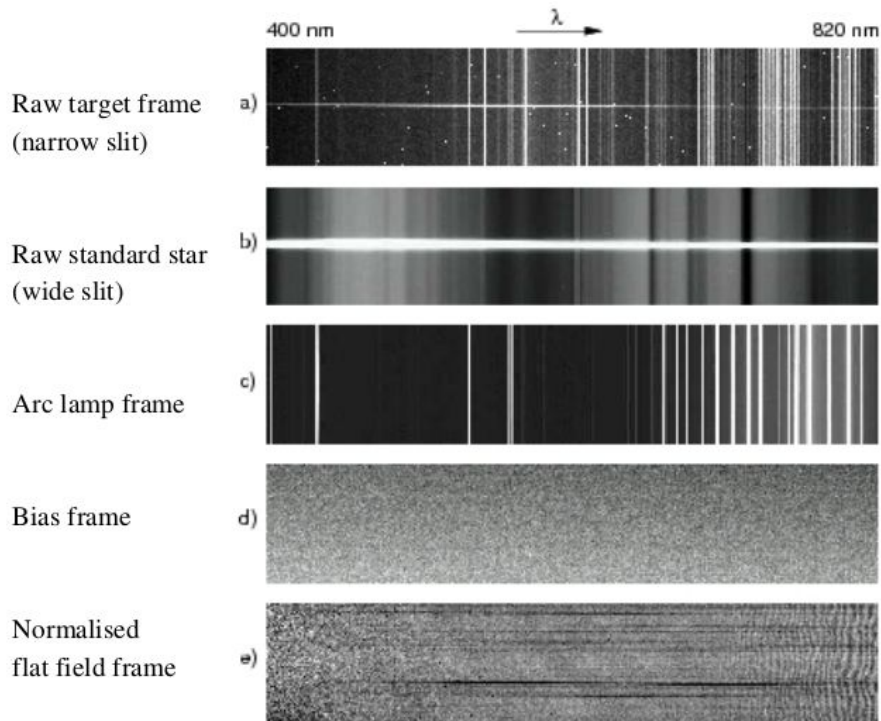
Single

Co-add



Reduced



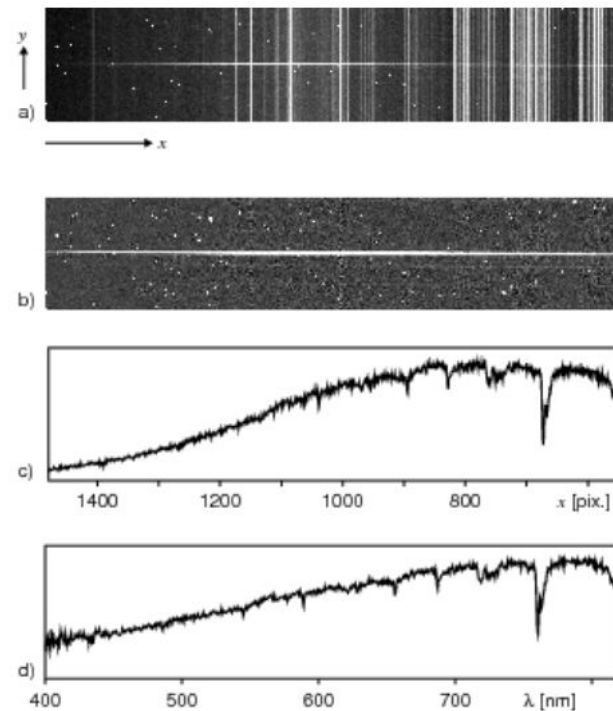


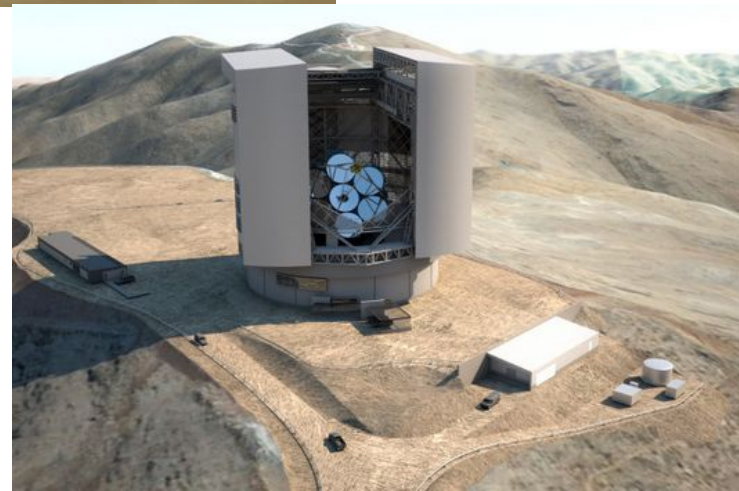
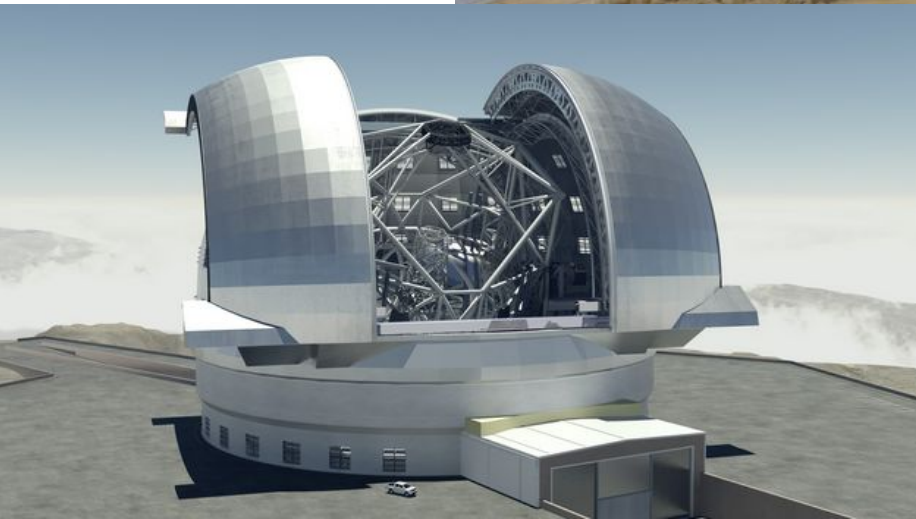
Raw target frame

Background subtracted target frame

Extracted spectrum


Wavelength calibrated







A New Global Array of Optical Telescopes: The Falcon Telescope Network

Francis K. Chun¹ , Roger D. Tippetts¹, David M. Strong¹, Devin J. Della-Rose¹, Daniel E. Polsgrove¹, Kimberlee C. Gresham^{1,2}, Joshua A. Reid^{1,3}, Casey P. Christy^{1,3}, Mark Korbitz⁴, Joel Gray⁴, Stanton Gartin⁵, David Coles⁵, Ryan K. Haaland⁶, Russ Walker⁷, Jared Workman⁷, John Mansur⁸, Victoria Mansur⁸, Terry Hancock⁸, Julia D. Erdley⁹, Thomas S. Taylor⁹, Richard A. Peters⁹, Christopher X. Palma⁹, William Mandeville¹⁰, Steven Bygren¹⁰, Christian Randall¹⁰, Kevin Schafer¹⁰, Tim McLaughlin¹⁰, José Luis Nilo Castellón^{11,12}, Amelia Cristina Ramirez Rivera^{11,12}, Hector Andres Cuevas Larenas^{11,12}, Andrew Lambert¹³, Manuel Cegarra Polo¹³, David Blair¹⁴, Mark Gargano^{15,16}, Jan Devlin¹⁷, Richard Tonello¹⁷, Carsten Wiedemann¹⁸, Christopher Kebschull¹⁸, and Enrico Stoll¹⁸

Despite enormous technical and human advances employed in the construction of these high-level research centers, many current advanced systems remain insufficient to successfully pursue lines of research that require systematic and continuous temporal studies. Studies to detect extrasolar planets using the technique of stellar variability involve making temporal observations over hours or even days (Charbonneau et al. 2000). Defining supernovae light curves requires taking data night after night for months (Filippenko 1997). Furthermore, observing the optical counterparts of Gamma-ray bursts (GRBs) requires rapid responses from the telescopes as the brightness of these transient astronomical phenomena can diminish below detection limits in a matter of hours (Gehrels et al. 2009).

FALCON-MM0 will be a key factor in this new astronomy era

1. Observation of objects that Giant telescope aren't able to observe
2. Rapid response again transient alarms.
3. Continuous and homogeneous photometric data.
4. Possibility of continuous observations for variable sources



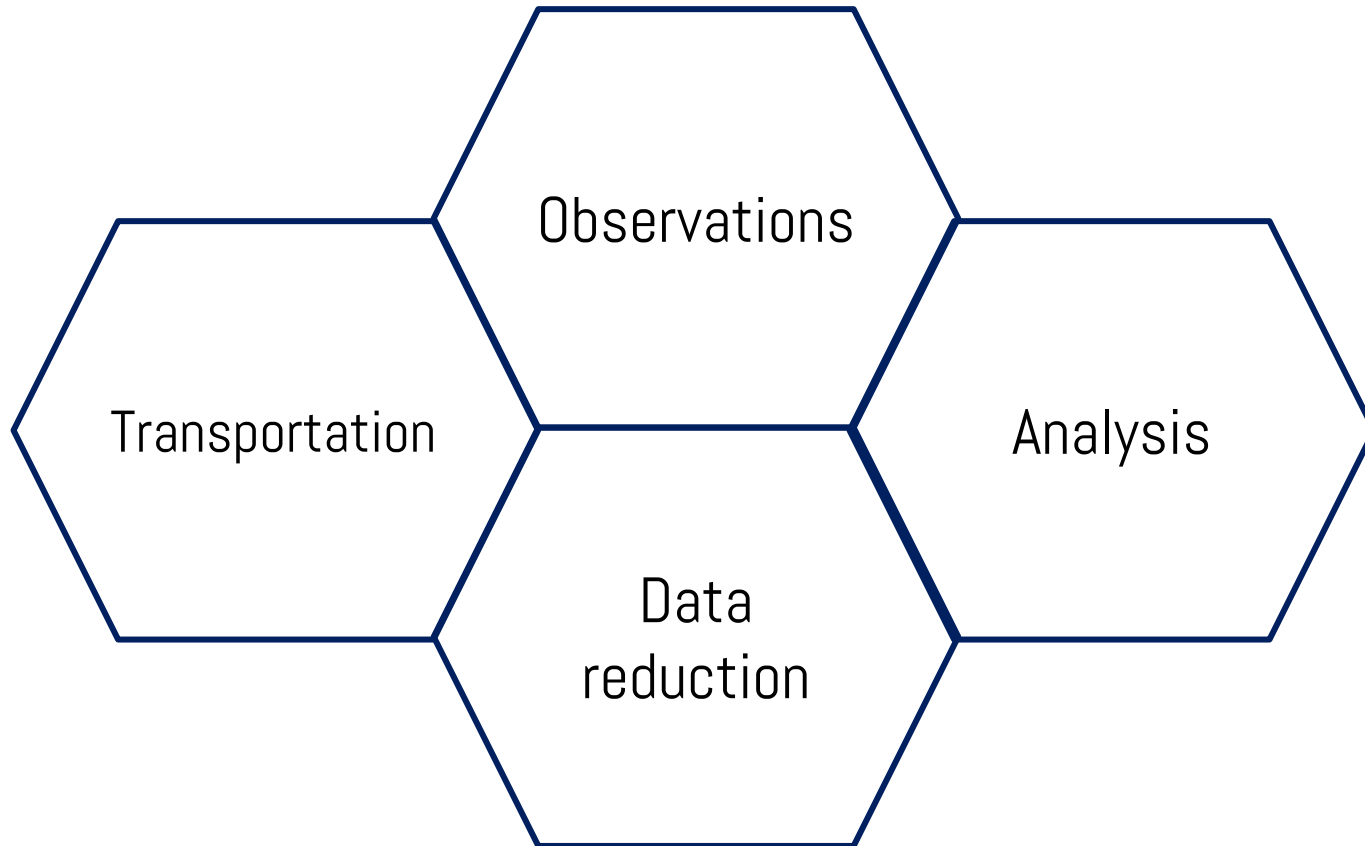
FALCON-MM0 as a key factor in the new astronomy era

1. Observation of objects that Giant telescope aren't able to observe
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We have the capacity to manage all these data?

We have the infrastructure to face this challenge in this new astronomy era?





Data Science Initiative

(Driven by astronomy)

Software
Development for
recognition of
objects.
(CampusDigital)

Data farm :
Center for
Computing
(CIC - ULS)

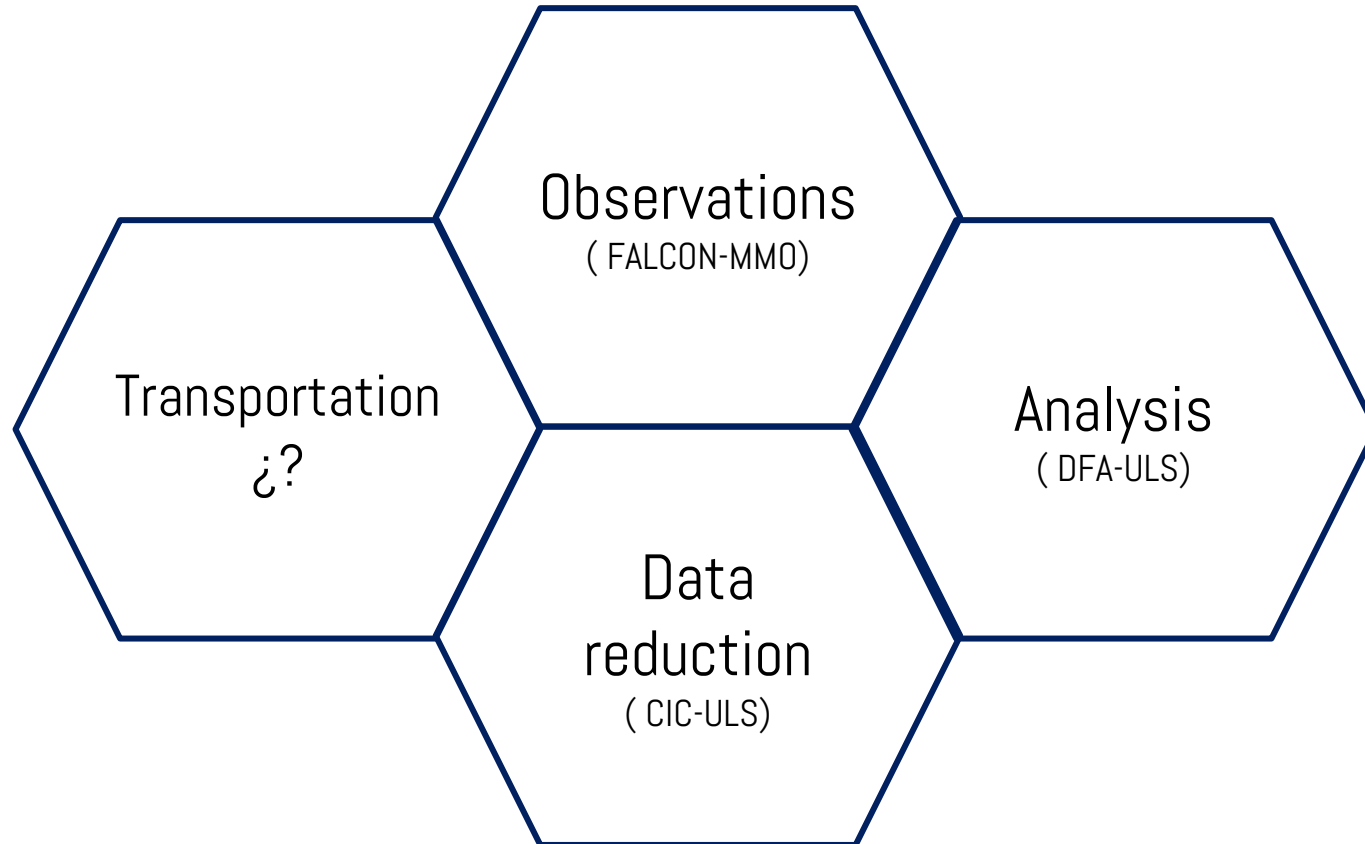
HPC and
Numerical
simulations
(DFA - ULS)

Astronomical
Observatories
(IMCT-ULS)

FALCON+SDSS+PI related projects

Facultad de Ciencias

(Dean Dra. Amelia Ramirez)



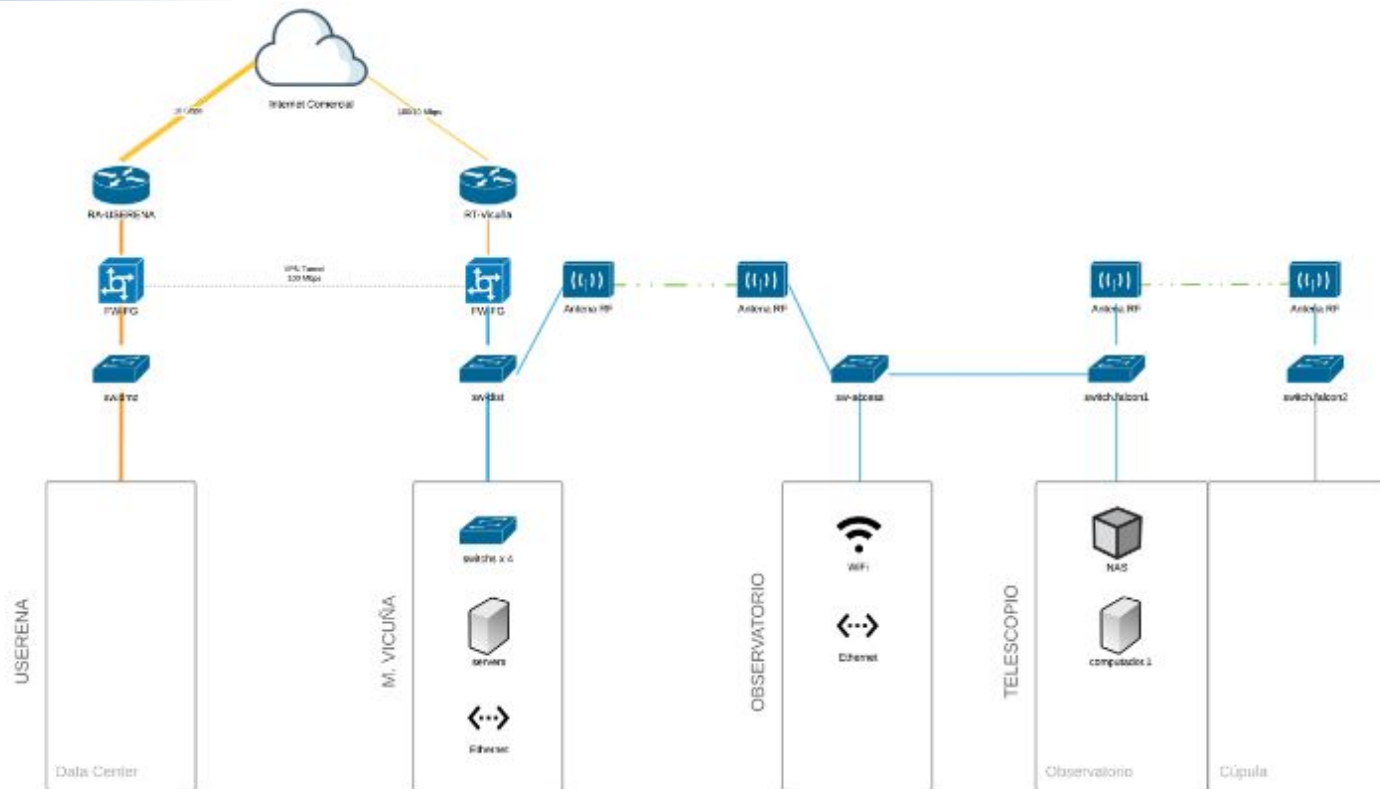
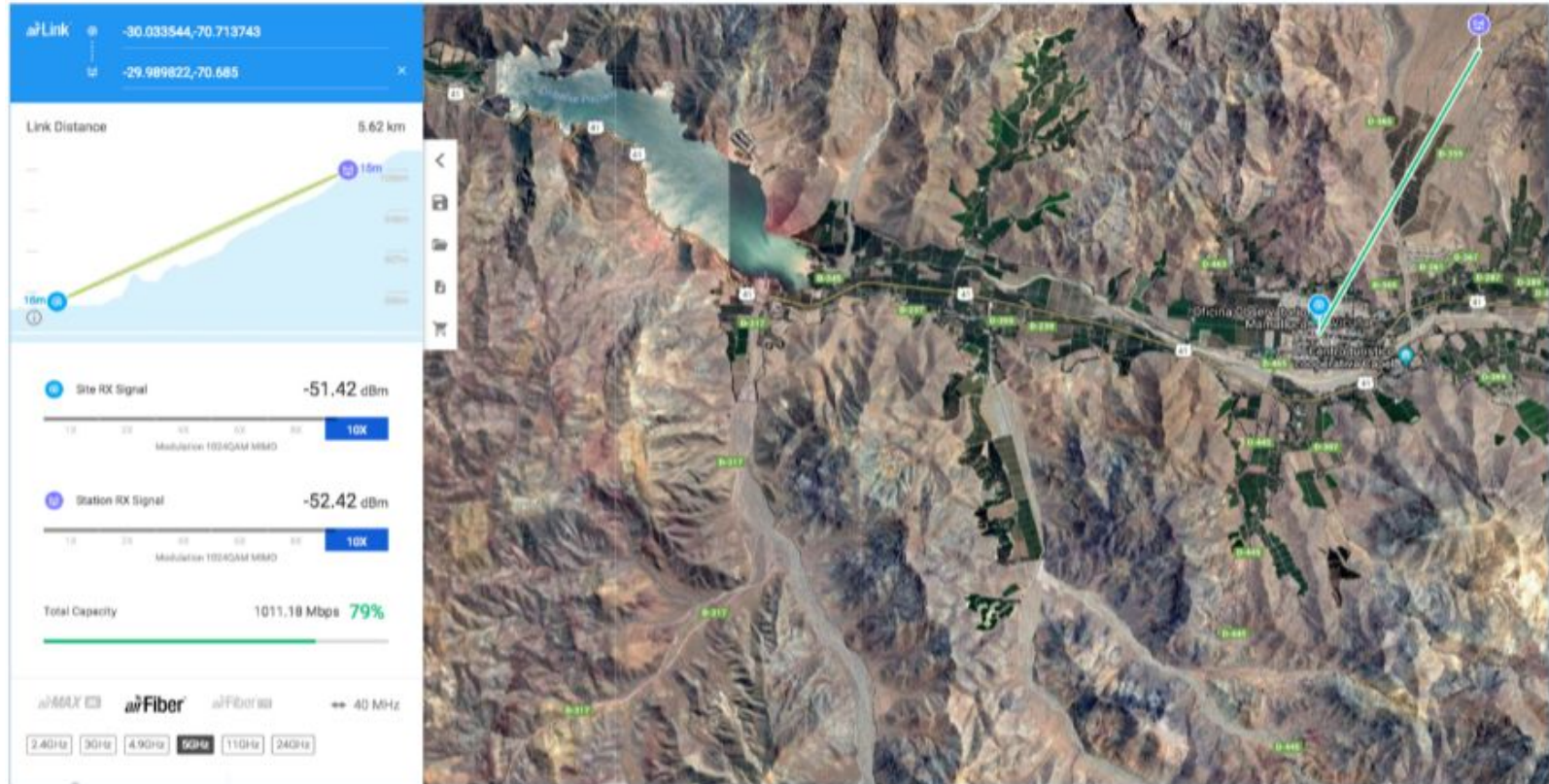


Fig.01 – Diagrama acceso internet Mamalluca, Vicuña, ULS e Internet.

Expanding the FALCON Telescope Network into the data science era

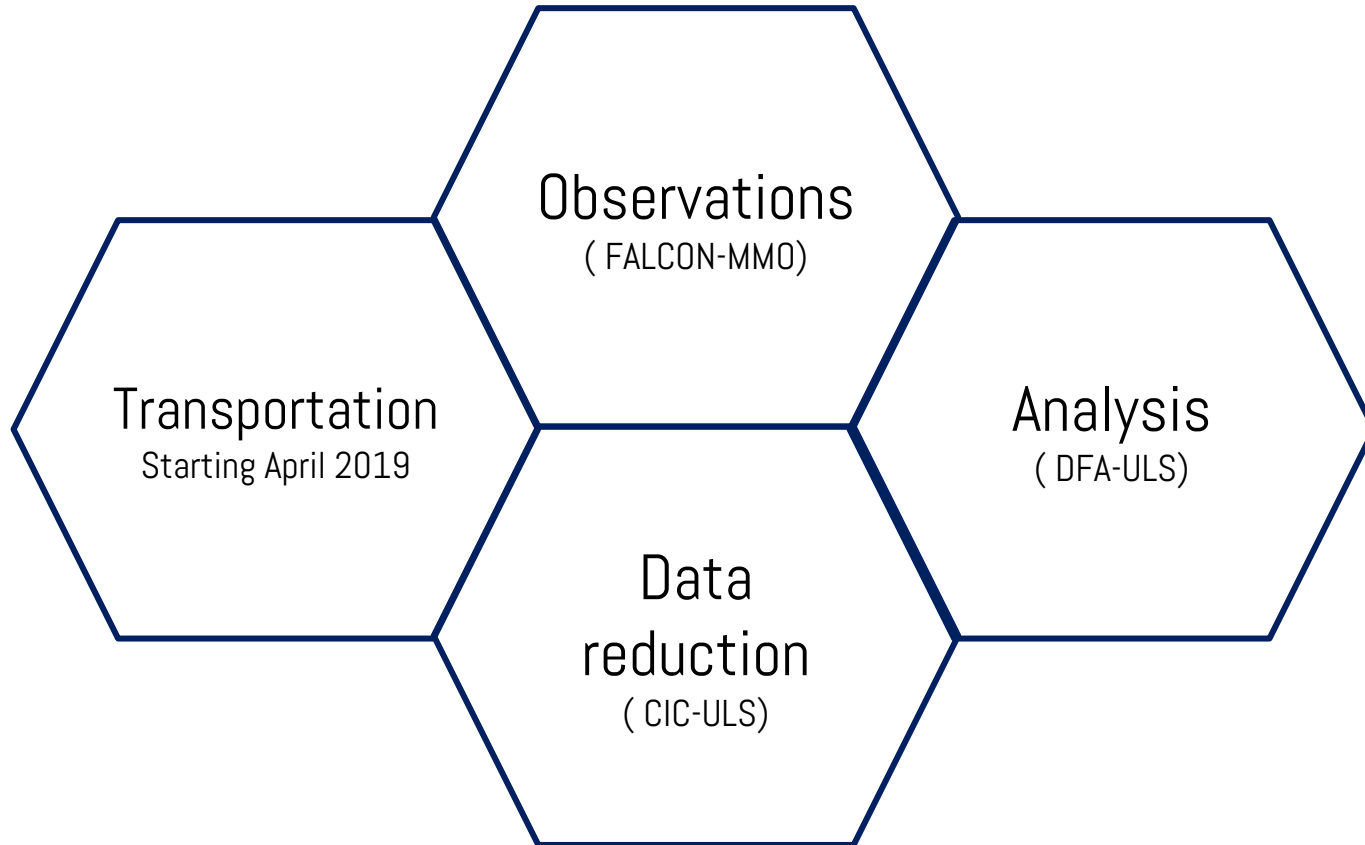
Award N°FA9550-18-1-0018





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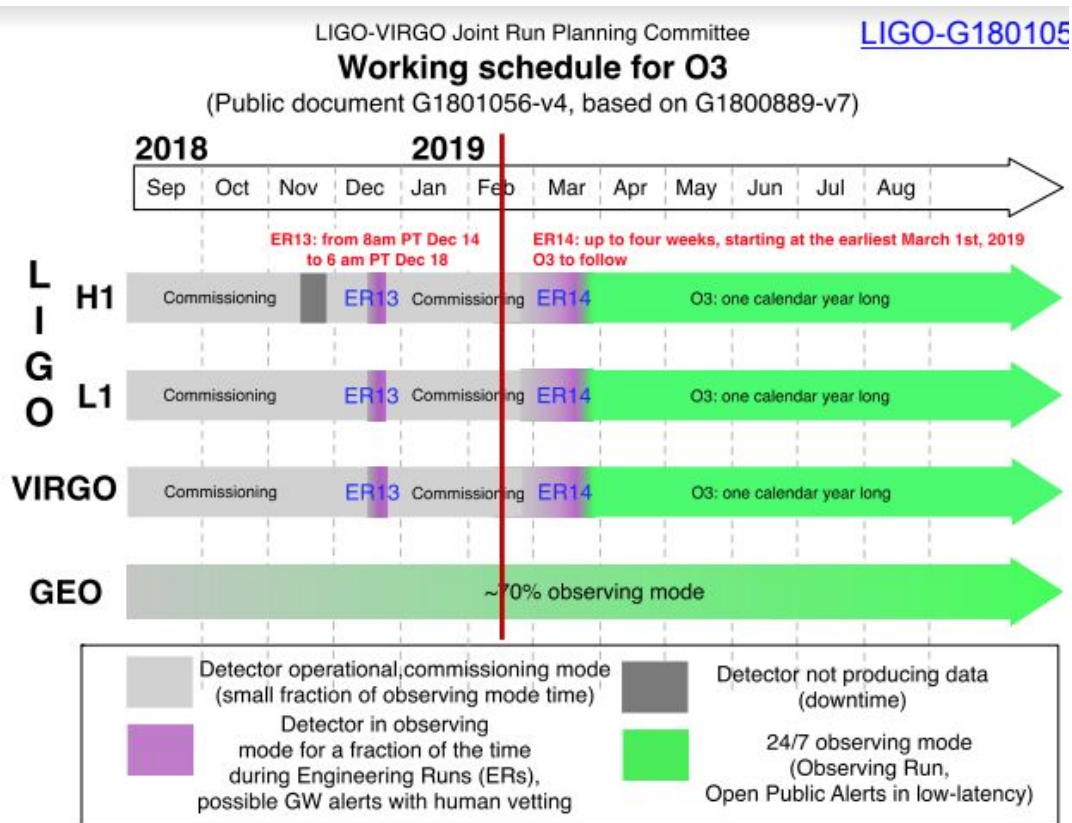
About expanding the FALCON Telescope Network into the data science era: We are ready!

Storage at CIC (1 PB)

Network : 1 GB from MMO to CIC-ULS.

10 GB from ULS to World (REUNA)







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Summary

1. Support University of La Serena to maintain & operate AFOSR- sponsored Falcon Telescope Network node for SSA, astronomy, education and outreach.
2. Collection of the different phenomenologies and the development of representations and algorithms to fuse them in to a usable set for identification of individual satellites is the next step in the use of small telescopes for SSA.
3. Photometry and Spectroscopy are related with significative amount of data.
4. The solution goes through a Data Science perspective
5. We developed a new network to transmit the data from Mamalluca To La Serena.
6. We are working in generate a new institution inside the University (The Data Science Initiative)
7. First test : LIGO/VIRGO Observation run 3.



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